permits the generation of a roughness and good grip characteristic for the virtual keys, and is in particular especially suitable for implementation of the output of a text display for blind persons.

[0017] A matrix of movable pins lying perpendicular to the display as a receptor is suitable for simulating the locking or yielding to a key depression. The detection of a virtual slider control is also simple to implement with this embodiment since only the state of adjacent pins needs to be checked in order to determine the direction of slider movement.

[0018] Arranging pins of the actuator matrix and the receptor matrix in alternation beside one another on the same level (layer) saves space.

[0019] Even more advantageous is an embodiment whereby the pins simultaneously fulfil the dual functions of actuator and receptor. By this means, the delimitation or labeling of a virtual key can be generated in an effective and space-saving manner (pins extended), whereby pressing (in) the pins enables detection of the contact on the one hand and the yielding or locking on the other. In addition, as a result of having the receptor and actuator functions in the same location, a more precise association between the detected contact point and the displayed virtual information is possible.

[0020] Piezoelectric elements are particularly suitable for drive purposes and for the detection of contacts since they are able to directly convert voltages (signals), generated by microprocessors for example, into pressure or movement and, in the opposite direction, pressure into voltages (signals) which can be immediately processed further, by microprocessors.

[0021] Electromagnetic elements are known, just like the piezoelectric elements, for the implementation of text output for blind persons, Braille, and are therefore easily obtained. One of the advantages of providing a sensor mat as the receptor is that the sensor mat can be procured cheaply as a mass-production item.

[0022] If the second layer is designed as a transparent sensor mat which in addition comes to be located immediately above the first layer, the mechanically flexible display medium is protected since it is no longer directly exposed to contact from a user. The life expectancy of the display medium, with its associated increased (procurement) costs when compared with the sensor mat, is increased.

[0023] An embodiment of the invention will be described in the following with reference to the single figure. This shows:

[0024] Side view of the layer structure of a touch-sensitive display with tactile feedback.

[0025] The figure shows a side view of a display structured in three layers S_1, S_2 and S_3, whereby a transparent flexible sensor mat comes to be located in the first layer S_1.

[0026] This sensor mat is designed such that it detects contacts and generates at least one first signal which at least determines the location (Cartesian coordinates) of the contact.

[0027] Immediately above this first layer S_1 is located the second layer S_2 which is formed by a flexible plastic membrane and is designed using the technology known as electronic paper.

[0028] Electronic paper is the name used by experts for a technology which combines the advantages of flat screens and printer ink on paper, in which tiny color capsules containing at least two colors—black and white for example—are used and the one or the other of their sides is made to point upwards on a paper surface, depending on an electrical charge. So-called plastic transistors are intended for use in controlling the electrical field required for this purpose.

[0029] Alternative technologies known to experts are "organic electroluminescence membranes" or "microencapsulated electrophoretic displays" which similarly permit an embodiment in the form of flexible, extremely thin display media.

[0030] The use of this technology on a membrane which is designed to be mechanically flexible and elastic is intended for the arrangement according to the invention in order that it can be mechanically manipulated in points so as to produce bulges on the surface of the membrane which are automatically returned to the normal state on termination of the mechanical manipulation.

[0031] Beneath the second layer S_2 is located the third layer S_3 which is formed by means of an area-covering matrix consisting of "knobs" $N_1 \ldots N_m$, designed as nylon or metal pins, which are arranged perpendicularly to the membrane surface and located so as to allow movement by piezoelectric operation.

[0032] In this situation, the three layers S_1, S_2 and S_3 are arranged in such a way that the piezoelectrically operated knobs $N_1 \ldots N_m$ are able to mechanically manipulate the first two layers S_1 and S_2 in points such that in an initial state keyboard delimitations and/or labels of a virtual keypad are generated on the surface of the second layer by knobs $N_1 \ldots N_m$ located beside one another, and can be felt by touch there. In this situation, the labeling can be generated in Braille in order that sighted users have the opportunity to see a virtual keyboard and its functionality displayed on the display medium, where they are able to feel the keyboard delimitation, while at the same time visually impaired users have the capability to feel the keyboard functionality by means of the Braille generated by the knobs $N_1 \ldots N_m$.

[0033] At least the second layer S_2 and the third layer S_3 are connected to a control unit μP which is designed in such a way that it is implemented in an initial state, in other words a state in which no input has (yet) been made by contact, for example a virtual keypad and/or a virtual menu bar resulting from the generation of at least one second signal, for controlling the knob matrix $N_1 \ldots N_m$. Furthermore, the control unit μP is designed in such a way that is generates at least one new second signal as a result of a contact on the sensor mat, whereby the contact must have taken place in a permitted area, in other words an area in which a virtual control element is displayed.

[0034] In addition, the control unit μP is also connected to another unit controlling the display, or forms a unit together with it, such that control signals for generating changes in the virtual control elements as a result of operator actions are also generated.

[0035] As an alternative to the sensor mat, a light grid may also be located in the second layer S_2.